Ecoregional Assessment of Water Quality in Virginia's Non-tidal Streams

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DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

BACKGROUND

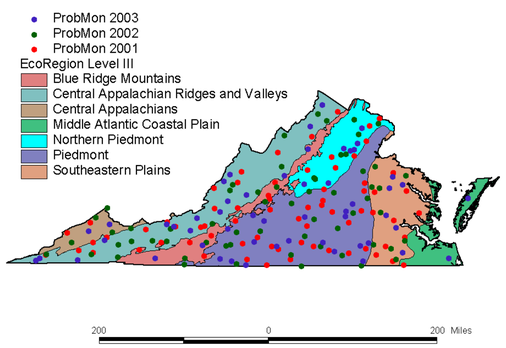
What is ProbMon?

- **A** probabilistic monitoring and assessment program
- **E**mploys a randomized system for selecting stations
- **P**rovides statistically based information about water quality in Virginia
- **I**ncludes all non-tidal perennial rivers and streams in Virginia
- **B**ased on EPA's Environmental Monitoring and Assessment Program (EMAP)

Station Locations

ProbMon coverage over the first 3 years (Chemical n=173, Biological n=159, Habitat n=157). One of the ProbMon survey goals is to identify trends and patterns by ecoregion. An **Ecoregion** is the region of relative homogeneity, of similar land surface form, soils, land uses, and potential natural vegetation, in an ecological system (Omernik 1987, Bailey 1976).

Station Locations



METHODS

DATA COLLECTION

- RBPII and MACS Methods for Macroinvertebrate and Qualitative Habitat data collection
- Chemical parameters collected using DEQ Standard Operating Procedures and analyzed by the Division of Consolidated Laboratory Services (DCLS)
- Modified EMAP Habitat Methods for Relative Bed Stability determination

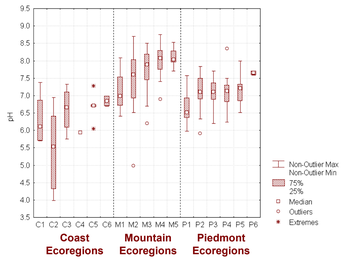
DATA ANALYSIS

- Virginia's Draft Stream Condition Index (SCI) is a multimetric index developed by TetraTech, Inc. The SCI incorporates 8 metrics: **EPT Taxa, Total Taxa, % Ephemeroptera, % Plecoptera plus Trichoptera (less Hydropsychidae), % Chironomidae, %2 Dominant Taxa, Modified Family Biotic Index, and % Scrapers**
- STATISTICA 5.1 was used to produce boxplots
- SAS was used to create Cumulative Distribution Function (CDF) Curves
- Land cover data analyzed using Spatial Analyst/ArcView 3.2
- Ecoregions were grouped:
  - **Mountain** = Central Appalachians, Central Appalachian Ridges and Valleys, and Blue Ridge
  - **Piedmont** = Piedmont and Northern Piedmont
  - **Coast** = Mid-Atlantic Coastal Plain and Southeastern Plains

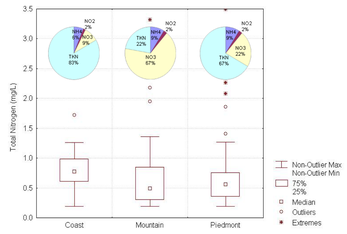
RESULTS

CHEMICAL RESULTS

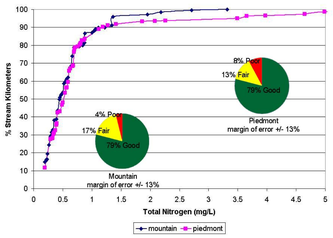
pH by Ecoregion and Stream Order



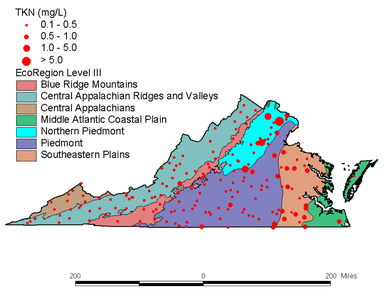
Nitrogen by Ecoregion



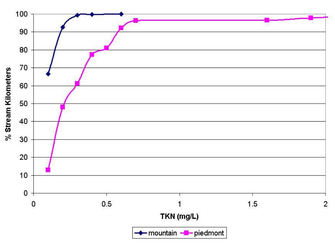
Nitrogen CDF Curves for Mountain (n=72) and Piedmont (n=77) Ecoregions



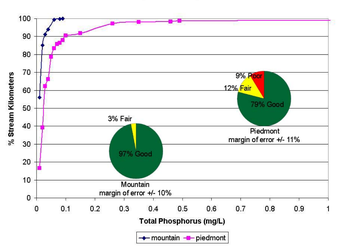
Statewide Distribution of TKN



Total Kjeldahl Nitrogen (TKN) CDF Curve for Mountain (n=72) and Piedmont (n=77) Ecoregions

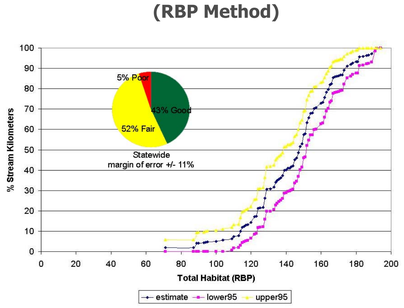


Phosphorus CDF Curves for Mountain (n=72) and Piedmont Ecoregions (n=77)



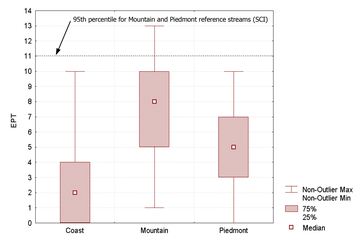
HABITAT RESULTS

Total Habitat CDF Curve (RBP Method)

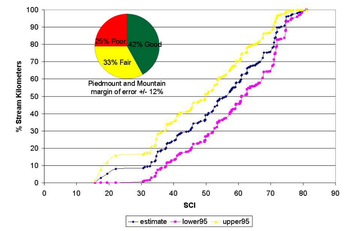


BENTHIC MACROINVERTEBRATE RESULTS

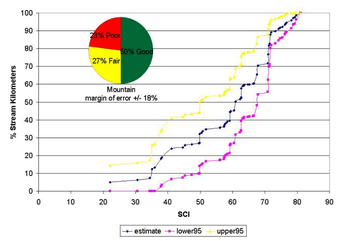
EPT Scores by Ecoregion



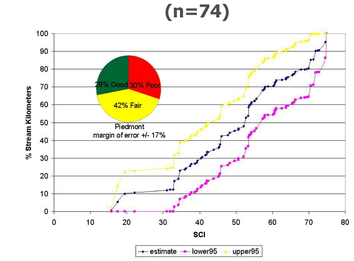
SCI Scores for Mountain and Piedmont Ecoregions (n=136)



SCI for Mountain Ecoregions (n=62)



SCI for Piedmont Ecoregions (n=74)



SUMMARY

After three years of data collection, DEQ has evaluated the status and conditions of streams in different ecoregions. The utilization of CDF curves allows DEQ to have more confidence in the results as confidence intervals decrease. ProbMon data yields a better understanding of statewide water quality. Interesting patterns of stream chemistry, benthic community indices, and habitat differences are emerging. pH appears to be higher in the Mountain ecoregions than in the Piedmont. Total Nitrogen concentrations are similar for both Mountain and Piedmont ecoregions however, when TKN is examined, ecoregional separation becomes obvious. Phosphorus levels follow a similar pattern to TKN. Total RBP habitat scores were separated at the following intervals: <100 are labeled *poor*, between 100 and 150 are labeled *fair*, and >150 are labeled *good*. 95% of stream kilometers are in the fair or good ranges for total habitat. With the application of the DRAFT SCI to the Mountain and Piedmont ecoregions, the Commonwealth has an estimate of the benthic community condition across a large portion of the state. The *good, fair,* and *poor* designations were assigned at SCI scores of >60, between 40 and 60, and <40 respectively. Approximately 75% of stream kilometers ended up in the Fair and Good ranges.

At the conclusion of the first five years of ProbMon data collection, DEQ will be able to evaluate how different management strategies such as water quality standards and TMDLs have affected water quality statewide. In addition, data from random sites will help illustrate the strengths and limitations of the SCI as an assessment tool. Data collection will continue through 2005.

ACKNOWLEDGEMENTS

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